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ABSTRACT

Presented is a module on air pollution for sixth through eighth graders. Six subsections address the many aspects of air and air pollution: (1) sensory awareness, (2) the nature of the atmosphere, (3) air pollution's effects on health and property, (4) values conflicts, (5) air quality control, and (6) individual responsibility. Learning strategies used range from values clarification and group discussion to observation, individual project work, and teacher demonstrations. Each subsection is organized as a teaching unit plan which includes objectives, a materials list, activities, and evaluation materials. Supplementary activities and a list of teaching resources are appended. (WB)

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HANDLE WITH CARE

. . . an air pollution module for sixth, seventh, and eighth grade teachers of health education, science, and other subject areas.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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FOREWORD

Long before the Industrial Revolution, the Earth's atmosphere was being polluted --- by volcanoes belching smoke and ash, by decaying vegetation and fetid swamps. And yet, it remained fit to breathe. Air acts to rid the Earth of wastes, and acts in such a way that it makes itself pure.

Today, the air is in danger. We are pouring more waste into our air than it can tolerate. The air that makes us sneeze and wheeze costs our nation over $16.9 billion a year --- in medical bills, lost wages, corrosion, crop damage, etc. It is estimated that unless air pollution is halted by 1985, the amount of sunlight reaching the earth will be reduced by one-half. Today, air pollution shuts out 45% of the sunlight over Los Angeles and 25% of the sunlight over New York City. An estimated 5% is shut out over rural areas.

Nature is overwhelmed...the challenge of cleansing the air now falls to us. Air quality has become a national interest, a government concern. But government concern is shortlived and ineffective if it is not supported by an informed and committed public. The adoption of Air Quality as a national issue has had a few side effects. There is now a wide and confusing array of air quality guidelines, regulations and plans.

All of which leads us to the production of this module...

"Handle with Care" presents the facts on air and air pollution, in a framework which emphasizes the roots of personal commitment. These "roots" are, simply, an awareness of the world around us and a sense of being inextricably tied to the fate of that world. A further dimension is the consideration of that "confusing array" mentioned above, in an effort to promote the understanding and confidence necessary to overcome the notion of the powerless individual.

Finally, this module deals with choice. In environmental issues, the alternatives are not always clearcut, nor do they inevitably lead to a bright or dismal future. But, the process of choosing is always there. It is our hope that through these learning experiences students will move from the realization that "a choice is made" to the belief that "the choice is mine."

INTRODUCTION: HOW TO USE THIS MODULE

"Handle with Care" is designed as a sequential, self-contained instructional packet. The operating principle is expressed as an overall Concept, which governs the approach to each section of the module. There are six subsections, each designed to reflect and teach a particular aspect of the topic related to a stated Subconcept. For each subconcept, there is a Teaching Unit Plan. The unit plan includes behavioral objectives, instructional sequence, materials and resources, methods, activities list and evaluation methods. Following the unit plan are the activity pages for that section. Each activity includes instructions for preparation, enactment and evaluation of performance, as well as sample pages for student handouts.

At the end of the module, there is an Additional Activities section. This contains exercises and methods which can be used as substitutes or further activities at various points in the module. The additional activities, like the unit plans, are arranged according to the subconcept to which they are related.

GRADE LEVEL

The contents of this module are intended for use in the sixth, seventh and eighth grade classrooms. Activities are designed to allow for some flexibility in the level of sophistication, in that introductory information, discussion questions, and individual and group performance criteria can be selected/developed as appropriate for a particular class. In addition, the instructor may substitute more or less complex activities at any point by choosing from the Additional Activities section. Many excellent activities can also be found in the reference materials included at the end of this module.

EQUIPMENT AND MATERIALS

Materials required for each section are listed within that section. The module provides activities and resources for the broadest possible audience. For this reason, the exercises included in this module do not require special classroom equipment. They feature basic and inexpensive materials, readily available to instructors. Any materials which require advance preparation on the part of the instructor are noted in the "Preparation" paragraph at the beginning of the activity instructions. Detailed instructions are also included to aid in preparation.

EVALUATION

At the conclusion of each unit plan, there is an Evaluation section. This identifies the activities within that plan which can serve as indicators of the achievement of both behavioral objectives and program objectives. Each activity sheet presents criteria useful for evaluation. These criteria are listed as either performance or program. Performance criteria are measures designed for use in evaluating student performance for grading purposes. Program criteria are intended to aid in the instructor's evaluation of the relevance and effectiveness of the particular activity, and of the module as a whole.

Evaluation for grading purposes presents a special problem in topic areas, such as ours, which rely very heavily on values education. Students cannot be assessed in terms of the values they adopt or hold. They can, however, be assessed in relation to the successful completion of tasks which involve the skills development and information acquisition necessary for values formulation. Performance criteria, then, focus primarily on the student's participation in, and completion of, exercises geared toward such development and acquisition. Hopefully, the student who meets performance criteria will ultimately reach program goals as well.

FIELD TRIPS

Each school system, each classroom has different time schedules and resources. For this reason, the module does not include specific time slots or sites for field trip activities. Such trips are, however, highly recommended at any point within the scope of the module. Below are some suggestions for field trip sites which can enhance the understanding and knowledge gained through in-class activities.

1) Visit an Inspection and Maintenance station. Have personnel explain the I/M process, costs, reporting method.

2) Visit the school heating system and/or incinerator. Have the maintenance person explain the system, any pollution controls observed, etc.

3) Visit a Pollutant Standards Index monitoring site with an appropriate agency representative who can explain the equipment, the reporting process.

4) Visit a local agency involved in air quality --- EPA, Lung Association, Clean Air Council, etc. --- and ask a representative to explain their role in the battle for clean air.

5) Visit a local factory, plant, mill. Have personnel indicate and explain the pollution controls in operation there, the effectiveness, the specific pollutants involved.

6) Attend a local citizen's group meeting.

7) Attend a local hearing on some environmental issue (mass transit, nuclear power, industrial expansion, etc.).

CONCEPT, SUBCONCEPTS AND UNIT PLAN INDEX

CONCEPT

ENVIRONMENTAL CONSCIOUSNESS AND THE IMPETUS FOR PERSONAL ACTION CAN BE DEVELOPED THROUGH LEARNING EXPERIENCES WHICH INCORPORATE FACTS, VALUES AND ATTITUDES.

SUBCONCEPTS

I. Heightened sensory awareness of the physical environment leads to appreciating and valuing that environment.
UNIT PLAN.....p. 11
ACTIVITIES.....p. 12-17

II. A knowledge of the nature of the atmosphere is a prerequisite for understanding the problem of air pollution.
UNIT PLAN.....p. 18
ACTIVITIES.....p. 19-27

III. Air quality affects health and property.
UNIT PLAN.....p. 28
ACTIVITIES.....p. 29-37

IV. Individual priorities and values may conflict with the public's need to secure and maintain environmental quality.
UNIT PLAN.....p. 38
ACTIVITIES.....p. 39-42

V. An understanding of the present air quality control structure provides a basis for decision-making concerning individual action.
UNIT PLAN.....p. 43
ACTIVITIES.....p. 44-46

VI. Each person is responsible, both individually and collectively, for the environment in which he/she lives.
UNIT PLAN.....p. 47
ACTIVITIES.....p. 48-56

TEACHING UNIT PLANS & ACTIVITIES

SUBCONCEPT

I. Heightened sensory awareness of the physical environment leads to appreciating and valuing that environment.

Behavioral Objectives

The student will...

a. evaluate his/her own level of sensory awareness.
b. examine the role of sensory awareness in emotional states.
c. seek to raise his/her level of sensory awareness through participation in structured activities.
d. demonstrate an understanding of the interdependence of life systems.

Materials

Poster board, markers, bulletin board (or wall space), chalkboard, writing supplies, seven balls of different colored yarn, set of Life System Identity cards

Methods

a. Observation and recording
b. Small group discussion
c. Class discussion
d. Individual project
e. Group activity: demonstration
f. Values clarification

Instructional Sequence

1. Observation Walk
2. Web of Life*

Evaluation

1. Compilation of "awareness" log, change in "awareness level" rating
2. Observation of Exercise No. 2

* Adapted from "Outdoor Education Guide" Curriculum Bulletin Number 79CBM76, Houston Independent School District, 1979.

OBSERVATION WALK

*Preparation:

1. Construct a 10 point "Average Awareness Level" chart for use on wall or bulletin board. This can be charted vertically or horizontally, using one color marker to make the chart, and reserving a second color for use in marking the class level. Values are depicted as:

1	2	3	4	5	6	7	8	9	10
Preoccupied			Passively aware		aware		actively aware		very aware

2. Copy "personal awareness level" sheet (one for each student)

Purpose and Instructions:

This is a four-part exercise designed to introduce the concept of environmental awareness on a general sensory level and allow students an opportunity to assess their own awareness level.

Students are to take a ten minute walk. This can be done within the school building, on school grounds, in an adjacent neighborhood, etc. During the walk they are to keep conversation to a minimum and concentrate on "noticing" objects, persons, smells, sights and sounds in their surroundings. They are not to stop and study, but should maintain a normal walking pace.

A. Upon return to the classroom, have each student respond to the following questions. Allow brief time for each response --- they should not be trying to think of what they observed, but be recalling surface impressions.

1. What did you smell first?
2. How many people did you see?
3. How many red objects did you see?
4. What was the sky like?
5. Did you see any litter? What kind?
6. What was the loudest sound you heard?
7. Did you see anything green?
   - List three green things you saw
   - Were they different shades of green?
8. Briefly describe the sight/sound/smell you encountered which was most unusual

When responses are complete, divide students into groups of three or four to compare notes. In so doing, they might consider:

What did A see that B did not?
How do the answers to No. 4 differ? to No. 8?

B. Have each student write a one word response to the following:

1. How I felt before taking the walk
2. How I felt during the walk
3. How I felt when the walk was over

Have students list responses on the board, under the headings "Before", "During" and "After". As a class, categorize and label each word as positive, negative or neutral according to the emotion it represents. Discussion can be generated concerning the relationship between one's surroundings and one's emotional state. Questions considered might include:

At what point were emotions most positive? why?
Were there specific reasons for responses (e.g. negative responses to seeing a lot of trash)?
Does what we see/smell/hear affect how we feel?
If you notice more, will you be affected more? Would this be a positive or negative change?

C. Distribute a "personal awareness level" sheet to each student. Allow a few minutes for completion, then have students convert their rating into a whole number and write it on the board. When students have written their rating on the board, calculate an average rating for the class. Mark this on the Average Awareness Level chart you constructed earlier, and post in a prominent spot in the classroom.

D. Ongoing "Awareness Evaluation" project

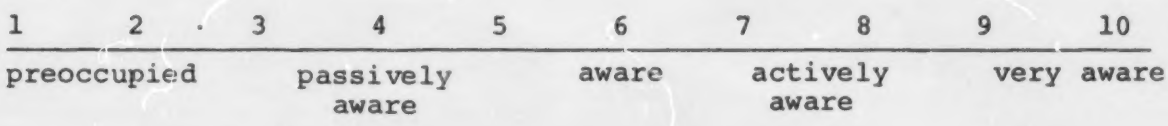
Have each student repeat this walk three or four times during the course of the next week. Each time, the student should keep a log of the things they never noticed before and revise their original rating as they see fit. At the end of the week, poll the students for new ratings and construct a new class "Average Awareness Level." If possible, allow students a few minutes in small groups to compare observations again. Discuss change (or, lack of change) and decide whether or not to continue monitoring awareness levels in this manner.

Criteria for Evaluation

Performance:
1. completion of responses, assignment of a rating
2. repetition of the walk, as evidenced by at least two log entries

Program:
1. emotional response to the walk -- was it a positive experience? were the negative emotions expressed related to the activity?
2. observe degree of enthusiasm for the ongoing project -- did most students repeat the walk? how often? were logs kept?
3. response to rating -- did students seem to be interested in raising their own levels? the class levels?

THIS IS YOUR PERSONAL AWARENESS LEVEL CHART. KEEPING IN MIND YOUR ANSWERS TO THE QUESTIONS ASKED EARLIER, AND THE POINTS WHICH MAY HAVE EMERGED IN YOUR SMALL GROUP DISCUSSION ...GIVE YOURSELF AN AWARENESS LEVEL RATING. MARK YOUR LEVEL ON THE SCALE BELOW.



WEB OF LIFE

*Preparation:

1. Make a set of Life System cards, using 3x5 index cards

   a. Take three cards. Label one Air, one Water, one Sunlight.
   b. Take ten cards. Label each one with either a non-human life form or an occupation commonly found in a forest environment (e.g., deer, mosquito, owl, camper, ranger, tree, moss).
   c. Label ten cards with a life form or an occupation commonly found in an urban environment.
   d. Label ten cards with a life form or an occupation commonly found in a rural environment.
   e. Make three cardboard or paper signs, one for each of the environments. Post or place these in three separate areas of the classroom.

   (See suggestions for Life System cards on next page)

Purpose and Instructions:

This exercise is intended to illustrate on a physical level the concept of interdependence of life forms.

Shuffle the Life System cards. Have each student select one card. If there are extras, make certain that the three Resource cards (Air, Water, Sunlight) are being included. The three students holding Resource cards do not take part in the first part of the exercise. When each student has chosen a card, tell them that they are now to select their most likely "habitat," either urban, rural or forest. When the three groups have been formed in their respective areas, the instructor asks if any of the members of a habitat are dependent on each other in any way. As a student explains how he/she is dependent on another, the ball of yarn is passed so that a visual connection is seen and the "web" takes shape.

After all the members of each habitat have been woven into their respective webs, students holding resource cards are each given a ball of yarn, and Air, Sunlight and Water are woven between the habitats. Now, the instructor takes the remaining color yarn and makes connections between habitats where suggested or appropriate.

When the Web has been completed, the instructor destroys some part of one habitat that leads to a chain reaction resulting in the destruction of the whole habitat. With that habitat gone, the chain reaction is continued through the lines to the other habitats. As a member is "destroyed," the student "plays dead" by dropping any yarn they hold to the ground.

Have students pick up their yarn, to revive the Web. Allow the students to think of new disasters (natural or man-made) and simulate the chain of events that might follow.

Discuss: What are we illustrating through this game?

Criteria for Evaluation

Performance: 1. Participation according to role selected -- appropriate response to disaster simulations

Program: 1. Ability to suggest and simulate a disaster chain
2. Ability to relate the game to the idea of interdependence

SUGGESTIONS FOR LIFE SYSTEM CARDS

FOREST HABITAT

deer	camper	chipmunk
mosquito	ranger	dragonfly
tree	squirrel	bluejay
owl	woodpecker	hikers
underbrush	bear	moss

RURAL HABITAT

cow	dairy farmer	wheat
field mice	chicken	children
birds	pigs	insects
farmer	grass	wildflowers
horse	corn	laborer

URBAN HABITAT

pigeon	factory worker	garden flowers
squirrel	school children	homemaker
sparrow	business executive	mice
cat	tree	insects
dog	shrubbery	bus driver

SUBCONCEPT

II. A knowledge of the nature of the atmosphere is a prerequisite for understanding the problem of air pollution.

Behavioral Objectives

The student will...

a. identify physical characteristics of air.
b. relate a weather pattern to changes in air quality.
c. investigate and evaluate local air quality.

Materials

Four balloons (same size); wire coat hanger; 2 clip clothespins; string; glass mixing bowl OR wide mouth glass jar; crayon; drinking glass or glass jar; buzzer or bell; beans -- four kinds (dried); shoebox lid; resource person A

Methods

a. Word game
b. Experiments
c. Resource person
d. Lecture, with charts
e. Research project (small group)

Instructional Sequence

1. Round Robin
2. The Nature of Air
   a. bean portrait
   b. water balloon
   c. balloon weights
   d. pressure test
3. Resource person A
4. Task Force assignments made

Evaluation

1. Participation in simple experiments, conclusions
2. Construction of model (No. 6)
3. Written response to resource person presentation

ROUND ROBIN

Preparation: None Needed

Purpose and Instructions:

Air is something we find everywhere --- in every place, at every time period. It is often encountered, yet not frequently discussed. Still, we all have impressions or ideas concerning Air and, thus, words describing air find their way into our reading, writing and speaking. The purpose of this exercise is simply to introduce the notion of "Air" and to discover some of those words. (It may, indeed, turn out to be a useful, simple pre-assessment exercise for you: How many technical or scientific terms emerge? How many pollution-related words emerge? Are most of the words positive in the state of emotion they convey? etc.)

Select one student to act as timekeeper, and give the bell or buzzer to him/her. Select one or two students to act as"listeners." The "listeners'" task is to be alert for repetition and to keep a count of the number of words suggested.

Have students sit in a circle, in desks or on the floor or in a grassy spot outdoors. Indicate the starting point. Each member of the circle is to say, in turn, a word describing or related to air. Each has 15 seconds to come up with a word, or be disqualified by the timekeeper's bell. "Listeners" will sound the bell if they note repetition, and the repeater has a second chance to suggest a new word. Note: any disqualified member remains a part of the circle, and adopts the role of listener. Go around the circle as many times as you can.

This strategy can also be used as an ongoing assessment exercise simply by changing the topic from words relating to Air, to words relating to Air Quality.

** This may also be done by two teams, each attempting to generate the longest list and remain active for the longer time.

Criteria for Evaluation

Performance: 1. Participation

Program: 1. Observation of interest, variety of words

THE NATURE OF AIR

*Preparation: None Needed

Purpose and Instructions:

AIR is a mixture --- not a chemical combination --- of a number of gases; that is, each gas retains its characteristic properties. Air is matter --- it occupies space and has weight. The components of air are as follows: 78% Nitrogen, 21% Oxygen, 0.03% Argon and trace amounts of several other, mostly inert, gases. The following three activities are designed to illustrate these basic characteristics of our air.

I. Bean Portrait (Air is a mixture, there are a number of components) -- Of the four different kinds of beans (or seeds, or beads) you have, select one kind to represent each of the components named above. Explain the components and their proportion, and place representative beans in a small box or shoebox lid. When all "gases" have been included, you can discuss:

1) A "mixture" --- each component retains its own characteristic properties
2) The nature of a mixture also means that gases are free to react and interact with new additions to the scheme, i.e. contaminants

EXAMPLE: Your box may end up containing

78 pinto beans (nitrogen)
21 garbanzo beans (oxygen)
1 kidney bean (argon)
1 lentil (trace gases)

or, depending on the number of beans you have at your disposal, these proportions can be multiplied for a greater contrast.

II. Water Balloon (Air occupies space)--see figure 1
Fill a glass mixing bowl (you must be able to see through the sides of the bowl) or a wide mouth glass jar about two-thirds full of water. Mark the water level with a crayon on the outside of the bowl. Take an empty balloon, insert it in the water (do not disturb the water level with your fingers --- dangle the balloon in the water up to about the point at which you would tie off a full balloon). Note the water level on

the side of the bowl with crayon. Next, fill a balloon with air. Insert this into the water in the same manner. Note the water level. Discuss:

- Was there any change in the water level when the empty balloon was inserted?
- Was there any change when the filled balloon was inserted?
- What caused the change?
- What does this tell us about the air inside the filled balloon?

III. Balloon Weights (Air has weight)--see figure 2
Suspend a wire coat hanger, with string, from the ceiling or in a doorway. With clip clothespins, attach an uninflated balloon to both angles of the hanger. The hanger should then be balanced and the bottom crossbar parallel to the floor. (If necessary, add a small piece of tape or string to one end to achieve balance). Next, remove and inflate one of the balloons. Reattach. Discuss:

Is the hanger balanced before we remove the balloon?
Is the hanger balanced now? Why not?
What does this tell us about the air inside the filled balloon?

IV. Air Pressure Test (Air exerts pressure)--see figure 3
Fill a jar or glass to the brim with water. Take a small sheet of paper and place it on top of the glass, pressing lightly to make a seal between the glass and the paper. Holding your hand over the paper, invert the glass. Once inverted, you can remove your hand --- the paper stays against the rim of the filled glass. Explain: Water and air both have pressure. Air exerts greater pressure than water, even though we may not be as aware of air pressure. In this experiment, the water (and gravity) are exerting downward pressure. The air is exerting upward pressure. The paper will not fall as long as the seal is not broken --- if this happens, the downward pressure is increased because there is now water and air in the glass.

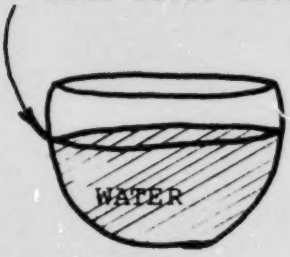
Criteria for Evaluation:

Performance: 1. Participation
2. Ability to identify the physical characteristics of air

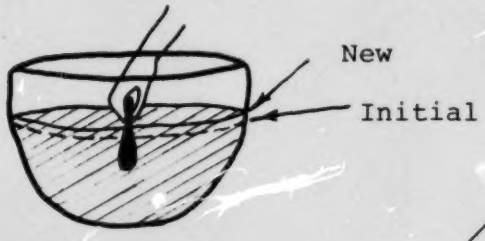
Program: 1. Active involvement in performing experiments, identifying causes and effects.

Figure 1

Note water level



Insert uninflated balloon; note water level



Insert inflated balloon; note water level

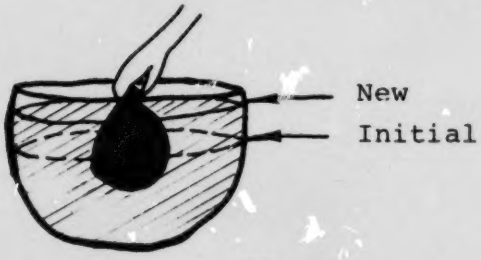
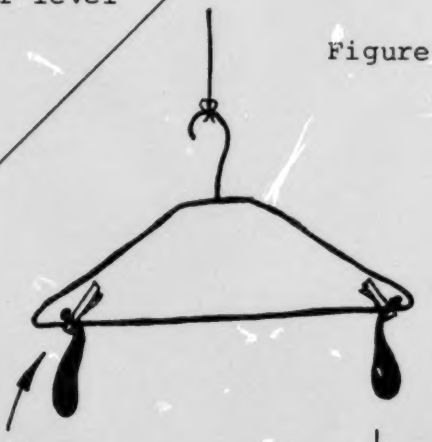


Figure 2



Detach, Inflate then reattach

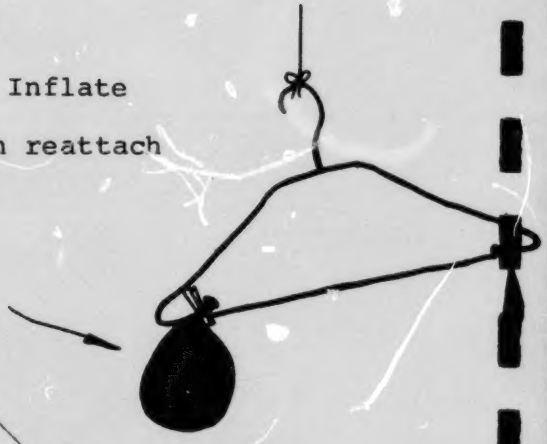
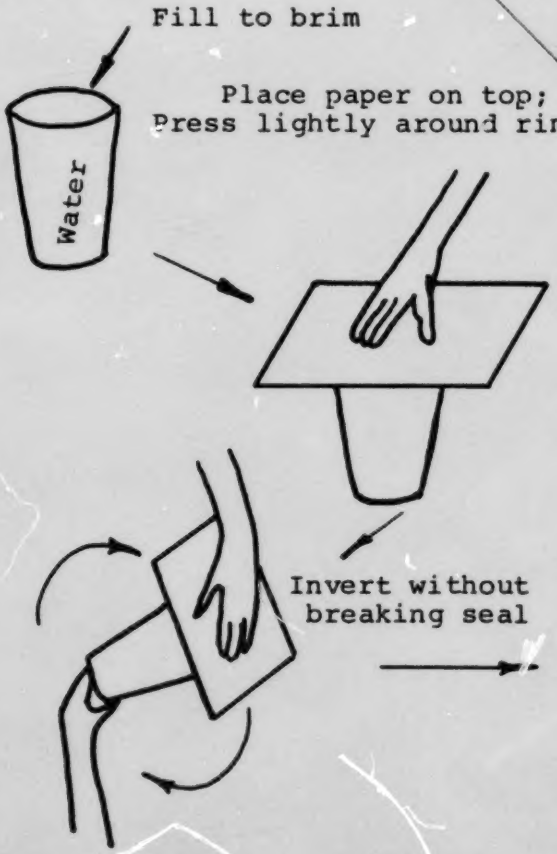


Figure 3



NOTES ON RESOURCE PEOPLE

*Preparation: None Needed

Purpose and Instructions:

Resource Person A

...A local weather reporter or meteorologist (check with radio and T.V. stations, or newspapers) who can discuss the effect of weather patterns and phenomena on air pollution levels. Some points which can be covered in the presentation include:

Inversions - subsidence and radiation
Greenhouse effect
Heat island effect
Mechanical turbulence
Stability vs. instability
Dust dome (or, haze hood)
Radiation, conduction, convection
Wind, rain as nature's dispersal and cleansing mechanisms for air

For review of the topic, read pages 7 - 18 of the Air Pollution Primer

Following the presentation...

1. distribute copies of the Speaker Evaluation Form to students (see page 56)
2. have each student write a brief paragraph defining and describing one of the terms listed above
   OR
   have each student make a sketch or watercolor depicting one of the conditions listed above.

Criteria for Evaluation:

Performance: 1. accuracy of written definition OR creative drawing

Program: 2. positive reaction to presentation

TASK FORCE INVESTIGATIONS: What is our air really like?

*Preparation:

1. Review the strategies suggested below to determine which are appropriate for your group. Materials availability may be a factor in your choice, since some of these projects do require equipment from outside the classroom.

Purpose and Instructions:

This activity is designed to allow students the opportunity to discover for themselves the true state of our air, and develop their own system of evaluating air quality.

Six strategies are suggested below for use in discovering air quality. You may choose to use only one for the entire class. We recommend the use of teams, each assigned to complete one investigative strategy and report to the class. Report guidelines should be established for each group. We suggest a group written report, according to the guidelines stated below, and a brief group oral report to the class. Investigation results can also be posted in classroom, hallway, etc.

Strategy #1: Vacuum Cleaner Project

Need: vacuum cleaner, filter paper

Fasten a piece of filter paper over the end of the vacuum cleaner hose which normally connects to the bag. Run the vacuum in the air for five minutes. Then, remove the filter and observe the amount of dirt which has been trapped by the filter paper. Label the paper with a) location; b) time of day and c) date.

Try this in four different locations, at three different times of day for the next 7-10 days. Evaluate your results in terms of the dirt evident on the filter paper. Assign a rating to each sample. Complete a report according to the guidelines given.

Stracegy #2: Tape Recorder Project

Need: tape recorder, tapes

Take five minute "sound samples" at four different locations, at three different times of day for the next 7-10 days. After

each sample, record an ID, including location, time of day and date. Note: As you record and play back samples make certain the volume setting is held constant. Evaluate your results in terms of the volume (loudness) of each sample. Prepare a report according to the guidelines given.

Strategy #3: White Glove Test

Need: several sheets of white paper, tissues

Do a "white glove test" in your neighborhood. You don't actually need gloves --- tissues or a finger will do just as well. Take a "dust sample" by wiping a tissue or fingertip across the test surface. Then, wipe the tissue or finger on a sheet of white paper to transfer the sample to paper. Mark each sample with location, time of day and date. Take samples at four different locations, at three different times of day for the next 7-10 days. Evaluate your results in terms of the dirt which transfers to the paper and prepare a report according to the guidelines given.

Strategy #4: Camera Survey

Need: camera, film, developing

Take photographic "samples" of visible air quality at three different locations, once in the morning and once in the afternoon, for the next five to seven days (be sure to include one weekend day). Keep track of when the picture was taken --- have a member of the group appear in the picture holding a sign with date, time. When film has been printed, assign a "visible air quality" rating to each photo and prepare a report according to the guidelines given.

Strategy #5: PSI Monitoring

Need: pamphlet or other material explaining Pollutant Standards Index

Monitor the PSI for your area for the next 7-10 days. Note the weather conditions on each day. Prepare a report according to the following guidelines:

1. What was the average PSI for the period you studied?
2. Was there weekday/weekend variation apparent?
3. What weather conditions did you find associated with a high PSI? low PSI?
4. Prepare a table of results.

5. Summarize your results --- What is our air really like? (brief paragraph)
6. Recommendations/reactions (brief paragraph)

* Check with your local health department (air quality division), local T.V. and radio stations for the information on daily PSI ratings.

Strategy #6: Rating Our Area

Determine the air quality in your city or area. Information on local air quality can be obtained from your city health department (air quality department), the state Air Control Board, local Chamber of Commerce, local EPA. Prepare a report according to the following guidelines:

1. Answers to the following:
   a. What is the general overall rating of the air quality according to an agency listed above?
   b. Are there any local monitoring sites used to determine air quality? how many?
   c. What pollutants are actually measured?
   d. Are the standards for that pollutant exceeded? If so, how many times a year?
   e. What sources of pollution contribute to the air quality in your area?
2. Map the local air quality monitoring sites, and indicate on the map the local sources of information on air quality.
3. Summarize your results --- What is our air really like? (brief paragraph)
4. Recommendations/reactions (brief paragraph)

GUIDELINES FOR STRATEGIES #1-4

Evaluate your results as indicated. Develop an air quality rating scale, and assign a rating to each of your samples. Prepare a report which includes:

1. Answers to the following:
   a. Which location had the highest rating? the lowest?
   b. Was there variation according to time of day? Explain.
   c. Was there variation according to the day of the week? Explain.

2. Construct a table of results
3. Summarize your results --- What is our air really like? (brief paragraph)
4. Recommendations/reactions (brief paragraph)

Criteria for Evaluation:

Performance: 1. Completion of written report according to stated guidelines

SUBCONCEPT

M. Air quality affects health and property.

Behavioral Objectives

The student will...

a. identify an air contaminant and indicate possible sources.
b. suggest a relationship between a source of pollution and personal health.
c. suggest a way in which he/she profits from a polluting source.

Materials

Film; projector; anatomical charts, drawings; food -- one large onion, one potato, one apple, two large carrots; bulletin board; tacks; colored paper; blindfolds

Methods

a. Film
b. Discussion
c. Lecture, with charts
d. Matching test
e. Model construction
f. Small group project (research and report)

Instructional Sequence

1. Health and air pollution
   a. Air as a medium
   b. Air as a nutrient source
2. Film (choose one from Resources, page 72)
3. Research assignment: the facts on air pollution
4. Air quality matching test,* Completion test*
5. Profit/Loss

Evaluation

1. Task Force report
2. Profit/Loss
3. Peer teaching project and test
4. Matching Test

* Option: These tests may be used in this section or postponed until the completion of the module.

HEALTH AND AIR POLLUTION

*Preparation:

1. Review Air Pollution Primer

2. For part A2, prepare potato, onion, apple and carrots by chopping into small cubes. Keep shape of pieces as uniform as possible.

Purpose and Instructions:

The roles of contaminated air are not so different from those of clean air. The main difference lies in the additional roles played by the contaminants. This series of activities and lectures is designed to explore the roles of air --- both clean and contaminated --- and their relationship with the body. Hopefully, students will discover, or rediscover, the extent of their dependence on air and the desirability of having clean air on which to depend.

Suggestion: Use prepared anatomical charts or drawings OR draw your own as you proceed.

A. Air acts as a medium through which things travel.

1) Sound Pose the old riddle, "If a tree falls in an empty forest, is there any sound?" Discuss:

a) Air carries sound waves
b) Sound "happens" when the waves contact our bodies (specifically, the ear)
c) Have half the students close their eyes and cover their ears tightly. Have the rest of the class close their eyes. Drop something - an eraser, a ruler - to the floor. Pick it up. Have students open their eyes and uncover their ears. Discuss: Was there a sound? (for half, yes; for half, no). As long as there was air to carry the sound waves, there was the capacity for sound.

Explain that excessive sound (noise pollution) moves similarly through the air to the point

of contact --- at which point severe damage can be done to the hearing mechanism.

2) Odors Have students form teams of four or five. One member of each team is blindfolded. The other members then select an assortment of six of the food cubes prepared above. Ask the blindfolded student to hold his/her nose, taste each food and identify it within 30 seconds. Other team members should note the samples given and whether or not they were identified correctly. Discuss:

- Were foods identified correctly? readily?
- What criteria were used to identify the samples? (ask this of the blindfolded tasters)
- What effect does sense of smell (the ability of the air to carry odors) have on taste?

Review the ability of the air to carry particles of various sizes --- just as the molecules of an apple or potato are carried to the nose as odor. This, then, relates to the ability of the air to carry unpleasant, even harmful, odors and fumes.

B. Air acts as a source of nutrients.

1) Body contact: eye tissue

Have students try to not blink for about five minutes. Was it difficult? How did it feel? Discuss:

The eyes are exposed to air, which can tend to dry them. Blinking restores the natural fluid protection to the eye's surface. This fluid barrier allows us to keep our eyes open so that we can see, and allows certain eye tissues to extract needed oxygen from the air.

When air containing particulate matter contacts this fluid barrier, particles are often left behind in the fluid. What might the effect of this be? (irritation, inflammation, tearing, blurred or obscured vision, scratching of eye surface, etc.)

2) Body inclusion: the respiratory system (see chart)

Our bodies rely on air intake to sustain body

functioning. The avenue for intake and use of air is the respiratory system. Discuss:

- the parts of the respiratory system
- air enters as a mixture, and the desired gas (O_2) is extracted.
- the lungs act as the primary site for distribution of needed oxygen to the body. Circulatory system takes over from there.
- the body has a return air system as well, with carbon dioxide returned to the lungs for exhalation.
- the role of cilia, mucus in the cleansing of the respiratory system

Review the idea that air is taken in as a whole, with the necessary oxygen extracted by the body; the way in which cilia and mucus aid in the "sorting out" of the undesirable components through their role in purification and exhalation. Remind the students that this also means that poor quality air is taken in as a whole --- visible and invisible contaminants included. Discuss:

- irritants in respiratory tract as preparation for infection
- the results of "overload" of the cilia mechanism by high level of particulate intake
- airway constriction (for example, as a result of sulfur oxide inhalation): the process and effects
- aggravation of allergic conditions (for example, asthma)
- lack of adequate oxygen supply ultimately affects the circulatory system
- the "burning" of cilia by inhalation of hot gases (for example, cigarette smoke)

Suggestion: A resource person might be helpful at this point, either to present the entire health effects topic or to elaborate upon the material you present. Possibilities include: school nurse, local physician or nurse or P.A., medical research personnel in your area specializing in respiratory disease.

RESEARCH ASSIGNMENT: The Facts on Air Pollution

*Preparation:

1. Make sure you have seven or eight copies of the EPA booklet, Air Pollution and Your Health.

2. Compile some research resources for the classroom, or check the resources available in the school or local library.

Purpose and Instructions:

This is a peer teaching exercise, designed as an alternative to lecture presentation by the instructor. The primary purpose of the activity is to introduce factual information about the major air pollutants, their sources and their effects. An additional purpose is the development of research and presentation skills on the part of the students. It is not possible to present all the information on air pollution within a limited class time schedule. Participation in this exercise aids students in developing a familiarity with information sources and information analysis which will allow them to pursue the topic independently if they wish to do so.

Divide the class into a total of seven groups, with at least three in each group. Each team is then assigned one of the seven major air pollutants as their research area. Within each research area, there are three topics to be covered (see below). You may assign topics to individuals, or have the group decide on the division of labor.

Each team is to research their pollutant, and present the information to the rest of the class. They are to teach their classmates about air pollution. For research purposes, each group should be given a copy of the EPA booklet, Air Pollution and Your Health and have access to the ALA Air Pollution Primer. Additional resources can include Health and Science textbooks, encyclopedia, etc.

SEVEN MAJOR AIR POLLUTANTS

sulfur oxides	particulates	carbon monoxide
ozone	nitrogen oxides	lead
hydrocarbons		

THREE AREAS TO BE COVERED BY EACH GROUP

1. The pollutant -- characteristics and sources
2. Standards for control, methods of prevention and/or control
3. Effects on health and property

Criteria for Evaluation:

Performance: 1. Have each team submit to you five "test" questions on their topic (you may specify multiple choice, essay, one word answer, etc., as you wish). From this pool of questions, you may select an appropriate number for inclusion in a quiz to be given when all the presentations have been made.

Name _____

Air Quality Matching Test

1. Hydrogen Sulfide
2. Ambient Air
3. Greenhouse Effect
4. Catalytic converter
5. Sulfur Oxides
6. Aerosol
7. Fly Ash
8. Emission
9. Photochemical Smog
10. Inversion
11. Attrition
12. Carbon Monoxide
13. Hydro Carbons
14. Ozone
15. PSI

13	Unburned fuels in gaseous or vapor form
11	One of the 3 basic contributing processes of air pollution
7	Partially incincerated matter carried in a gas stream (e.g. cinders, soot, dust)
6	A suspension of liquid or solid particles in the air
10	Surface air is held down along with its pollutants
4	Reduce nitrogen oxide emissions from motor vehicles
2	Any unconfined portion of the atmosphere; the outside air
9	Air pollutants interacting with sunlight
14	The principal component of smog
15	Use of monitoring sites to determine levels of air pollutants
3	The heating effect of the atmosphere upon the earth
1	Formed by the combustion of fossil fuels
12	Formed by the incomplete combustion of fossil fuels
5	Byproduct of refinery activity; odor of rotten eggs
8	A discharge of pollutants into the environment

Name _____

Air Pollution and Your Health

1. The word smog was coined from *SMOKE* and *FOG*.

2. Smog is made up of *PHOTOCHEMICAL OXIDANTS*, mainly, which is a kind of air pollution formed from *AUTO EXHAUST* and *INDUSTRIAL EMISSIONS* spurred by *SUNLIGHT*.

3. There have been tests to show a positive relation between air pollution and *RESPIRATORY AILMENTS*, *HEART DISEASE* and *CANCER*.

4. Large masses of polluted air can drift with prevailing winds from the city. EPA scientists have traced air pollution from the city of St. Louis as far as *100* miles away.

5. The EPA is responsible for:

   1. *DETERMINING WHAT KINDS OF POLLUTANTS ARE HAZARDOUS*.
   2. *SETTING STANDARDS*.
   3. *ENFORCING ADHERENCE TO THESE STANDARDS*.

6. EPA stands for *ENVIRONMENTAL PROTECTION AGENCY*.

7. Five hazardous substances, designated by the EPA because they have disease risks at low concentrations are:

   1. *SULFUR OXIDES*
   2. *PARTICULATES*
   3. *CARBON MONOXIDE*
   4. *OZONE*
   5. *NITROGEN OXIDES*

   (ALSO, HYDROCARBONS, LEAD)

8. What does PSI stand for? *POLLUTANT STANDARDS INDEX*.

9. PSI provides a simple, uniform way to report daily air pollution concentrations.

   1. At what index value should elderly people stay indoors? *200*.
   2. At what index value should healthy people stay indoors? *300*.
   3. Index values from *0* to *49* are considered good.
   4. Index values from *200* to *299* are considered very unhealthful.
   5. At what index value do symptoms begin in healthy people? *100*

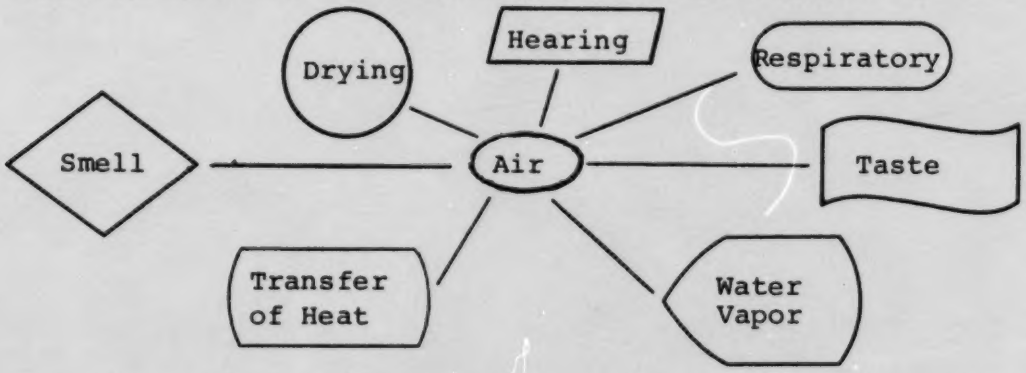
PROFIT/LOSS

*Preparation: None Needed

Purpose and Instructions:

This activity is intended to encourage an analysis of the implications of learned facts for everyday life. In addition, it focuses on the idea that there are "trade-offs" which affect our commitment to clean air.

"One picture is worth a thousand words." Have class construct a wordless bulletin board or wall display depicting what has been discussed about air thus far. A "bean portrait" of air can be made by gluing the beans used earlier to a cardboard sheet, or box lid, in some creative pattern. This might serve as the central symbol for the display. Other representations should include the roles of air. One possible arrangement (with symbols instead of words, of course!) suggested:



Have students review the picture created. Now that they know more about the factors which change air, the picture can be expanded:

1. Construct wordless symbols for a few pollutants.
2. Add these to the picture, in some way which indicates at least one possible impact on the roles of air.
3. Consider the pollutants named. Now, construct a symbol which illustrates some way in which you profit from the source of that pollutant (for example, carbon monoxide--Loss; interference with respiration; Profit: transportation, in that auto exhaust can be a source).

Discuss:

1. What kind of picture are we left with?
2. How do profit and loss compare?
3. How do you feel about the idea that we "profit from pollution"?
4. Do you think that profit without loss is possible? desirable?

Criteria for Evaluation:

Performance: 1. Participation in the selection, and construction, of symbols.

Program: 1. Inclusion of the roles of air discussed earlier.
2. Ability to translate facts into symbols chosen from everyday life.

SUBCONCEPT

IV. Individual priorities and values may conflict with the public's need to secure and maintain environmental quality.

Behavioral Objectives

The student will...

a. identify characteristics of their environment which they wish to preserve, and those which they wish to alter.
b. given a problem-solving situation, propose a course of action and a supporting rationale.
c. demonstrate a relationship between individual values and environmental concerns.

Materials

Poster board and markers OR chalkboard and colored chalk OR assorted pictures for collage

Methods

a. Group construction of model
b. Small group problem-solving
c. Informal debate
d. Class discussion

Instructional Sequence

1. Baker's Dozen*
2. Real/Ideal

Evaluation

1. Exercise 2
2. Chart construction for Exercise 1

* Adapted from J.S. Greenberg, Student-Centered Health Instruction: A Humanistic Approach. CA: Addison-Wesley Publishing Company, 1978.

BAKER'S DOZEN

*Preparation: Copy calendar/instruction sheet (one for each student)

Purpose and Instructions:

Often, a gap exists between what we profess as our environmental concerns (for example, the wasting of natural resources, pollution) and our daily behaviors. The purpose of this exercise is to aid students in confronting their own behavior and values relative to environmental concerns, to discover whether such a gap exists.

Distribute the calendar/instruction sheets to the students, and allow time for completion. Since this exercise involves charting items over a period of time, you will then have to have an update on the exercise. At the time of the update, students can submit their completed calendars along with a brief paragraph including such points as:

1. whether it was easier or harder to do without the three items than you thought it would be

2. whether you feel this monitoring has had any effect on your energy using attitudes

OR

at the time of the update, the above points can be discussed and total energy use compared or analyzed. Students can then choose two additional items to "live without" for the next seven days. Charting continues as in the previous week, on a new calendar. The difference is that the number of items that are used is now down to eight. An update must then be held the following week.

Criteria for Evaluation:

Performance: 1. completion of the energy use calendar, summary paragraph.

BAKER'S DOZEN

1. IN THE COLUMN AT THE LEFT LIST 13 THINGS YOU USE WHICH REQUIRE ELECTRICITY.
2. CROSS OUT THE THREE THINGS YOU COULD MOST EASILY LIVE WITHOUT.
3. CIRCLE THE THREE THINGS YOU WOULD MISS MOST IF A POWER FAILURE OCCURRED.

Items Which Use Electricity	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Total Use
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.								

4. USING THIS CALENDAR, CHART YOUR USE FOR THE NEXT SEVEN DAYS. EACH TIME YOU USE AN ITEM ON THE LIST AT THE LEFT, PLACE A ✓ IN THE BOX FOR THAT DAY.
5. FOR THE NEXT SEVEN DAYS, TRY TO NOT USE THE THREE ITEMS YOU CROSSED OUT (Keep track of any times you do use one of them).

REAL/IDEAL

*Preparation: None Needed

Purpose and Instructions:

An important element in developing an "environmental conscience" is a determination of one's priorities. In this exercise, students are asked to assess their environmental priorities --- what they like or dislike about their world. Following this, the questions of group consensus and conflict are addressed in terms of environmental problems and solutions.

As a class, construct a realistic portrait of your environment. Have the class propose those elements which should be included in the portrait (for example, homes, trees, litter, etc.). Make it fairly detailed (don't forget the inanimate essentials, such as air, sunlight). This can be constructed in several ways:

1. Drawing with colored markers on large sheet of paper, cardboard
2. Cut out representations, tacked on a bulletin board
3. Colored chalk drawing on chalkboard
4. Listing on paper, poster or chalkboard
5. Collage of photos, magazine pictures on bulletin board or wall

Once the portrait is complete, divide the class in half. One group should compile a list of five elements in the portrait they most wish to preserve. The other should compile a list of five elements they wish to alter, or remove entirely. Have a member of each group present their list to the class at large, and secure class support for each item.

Divide class into groups of four or five students each. Each group is given one item from the "preserve" list and one from the "alter" list. Their task as a group is to determine how best to preserve/alter the elements they are assigned. They are empowered to enact laws, or recommend personal action. Whatever means are chosen, they must be specific. They are to arrive at a consensus (not a majority decision) on the issues.

When each has arrived at a consensus (or, announced deadlock**) one member from each group presents the decisions to the class

at large. Discussion of each decision can then be generated with reference to:

1. short term and long term effectiveness
2. impact on individual lifestyles
3. impact on local industry
4. enforcement or enactment problems

and a poll taken to determine which decisions are supported by a majority of the students.

** A group which announces "deadlock" is asked to present a summary of the irreconcilable views. The class can then discuss possible alternatives, and determine which view has majority support.

After each group has presented and polled for support, ask the class to consider the following questions:

1. Was it difficult to achieve consensus within a small group?
2. Did you feel that the members of your group shared similar values regarding the items in question? Why or why not?
3. If small group consensus was difficult, does this suggest anything to you about what might occur within a larger group, such as a community council or government hearing?
4. Do you think the proposals supported by the majority in this classroom would find support in the community? Why or why not?

Criteria for Evaluation

Performance:
1. observation of participation in group process
2. demonstration of support for, or opposition to decisions presented
3. optional: written answers to discussion questions at end

Program:
1. incorporation of the consideration of impact on lifestyle (community and individual) within group decision
2. articulation of the premise that a person (or group) may not agree on a "means" even though they desire the same "end" (i.e. the Ideal)

SUBCONCEPT

V. An understanding of the present air quality control structure provides a basis for decision-making concerning individual action.

Behavioral Objectives

The student will...

a. seek information on air quality control regulations and related questions (for example, problems of enforcement).
b. identify an air quality control regulation pertinent to local industry.
c. propose a relationship between community support and local pollution control enforcement.

Materials

Resource Person B

Methods

a. Lecture
b. Debate
c. Values continuum

Instructional Sequence

1. Resource person: presentation
2. Opinion Continuum

Evaluation

1. Speaker evaluation form
2. Opinion Continuum
3. Pooled questions for quiz

NOTES ON RESOURCE PEOPLE

*Preparation: None Needed

Purpose and Instructions:

Resource Person B

...a local EPA or Air Control Board representative (or, a representative from the Lung Association, Citizens' Environmental Interest Group, etc.) who can discuss air quality control laws, standards, enforcements, etc. Some points to be covered in the talk can include:

Clean Air Act of 1970
Amendments to Clean Air Act, 1977
"Primary" and "Secondary" Standards
Reporting process (violations)
Penalties, degree of enforcement

For brief review of the topic, see pages 4 and 5 of the EPA booklet, Air Pollution and Your Health.

Following the presentation...

1. Distribute speaker evaluation form (see page 56)
2. Have students construct their own quiz as follows:

    1. Divide students into groups of four or five.
    2. Have each group submit three objective quiz questions based on the material presented.
    3. Have each group submit one brief essay question based on the material presented.
    4. Pool the questions submitted and select 10 objective questions and two essays for a class quiz.

OPINION CONTINUUM

*Preparation: None Needed

Purpose and Instructions:

Now that the students are better informed as to the legal aspects of air quality, it is appropriate to discuss their impressions of the state of the law. Satisfaction or dissatisfaction with the legal structure, enforcement, the fate of violators, etc., can be a major factor in the decision to become involved or to not become involved. This exercise is designed to assist the students in clarifying their views on the role of the law.

Draw a continuum on the chalkboard ranging from strong disagreement to strong agreement.

e.g.

---

strongly disagree — disagree — no opinion — agree — strongly agree

and instruct students to draw a set of five such opinion lines (Note: not to be collected --- for their use only). As you read a statement aloud, they are to indicate their reaction by placing a mark at the proper place on the continuum. There are five statements, one for each line.

1. Air quality control regulations are adequate.
2. Pollution control regulations are enforced fairly and adequately.
3. Pollution control regulations put the interests of personal health and safety above those of commerce and industry.
4. Pollution controls should be decided by scientists, not by business.
5. The most effective way to control pollution is by enacting and enforcing laws.

When students have recorded their responses on their own papers, they can be asked (not required) to affirm their opinions to the class at large. For each statement, in turn, ask students to line up and mark their position on the continuum drawn on

the chalkboard. When all marks have been made, the class as a whole can discuss the results (for example, is there a diversity of opinion? a similarity? Does anyone wish to defend a minority opinion? a majority opinion?)

NOTE: This may also be conducted as a small group exercise. After all students have indicated their responses on their own papers, the class can be divided into five groups. Each group takes one statement and compares responses, engaging in debate or discussion.

Criteria for Evaluation:

Performance: 1. completion of individual continuums

Program: 1. voluntary affirmation of opinion, through marking position on the chalkboard continuum

SUBCONCEPT

VI. Each person is responsible, both individually and collectively, for the environment in which he/she lives.

Behavioral Objectives

The student will...

a. construct a pollution pathway and propose points of impact for the most desirable (to the student) long term control.
b. investigate and assess community attitudes towards individual action.
c. participate in a long term class project (voluntarily).

Materials

Large sheets of white paper, colored markers, assorted magazines for collage construction, reference materials

Methods

a. Group construction of model, collage
b. Individual interview research
c. Problem solving
d. Brainstorming
e. Sentence completions
f. Voting: group decision-making

Instructional Sequence

1. Pollution Pathway
2. Community Opinion
3. Sentence Completions
4. Class Project

Evaluation

1. Pollution Pathway
2. Community Opinion report
3. Voting on class project

POLLUTION PATHWAY

*Preparation: None Needed

Purpose and Instructions:

This activity is intended as both a review of factual information concerning air quality and an introduction to the idea of personal responsibility and action.

This can be done as a class, in small groups, or even by individual students.

Pick one pollutant. Construct a pathway, tracing the pollutant as far as possible back to its point of origin. Do this on the chalkboard, on large sheets of paper, or on individual papers. Examine the pathway, and answer the following:

1. At what point(s) could this pathway be obstructed?
   a) Does this involve one person? more than one person?
2. At what point could it be obstructed by a large group of people (for example, a community group, a corporation)?
3. At what point could it be obstructed by legal means?
4. What might be some broader effects of obstruction at each of these points?
5. If you were charged with the task of breaking this pathway, what action would you prefer to take as an individual?
6. Does individual action really make a difference?

Criteria for Evaluation:

Performance: 1. participation in construction and/or examination of the pathway, through verbal response

Program: 1. ability of the group(s) to reconstruct a correct detailed pathway
2. ability of the students to suggest and discuss the broader impact of points of obstruction
3. voluntary statement of opinion on the importance of individual action

NOTE: If students wish, the Pollution Pathway and points of impact could be constructed and posted for display in school hallways, at a PTA meeting, etc.

COMMUNITY OPINION

*Preparation: None Needed

Purpose and Instructions:

A major part of values formation and attitude change is development of the ability to affirm one's belief when confronted with disagreement. Values which are promoted in the classroom may not find active, widespread support in the community at large. This three part exercise is designed to give students an idea of the attitudes they will encounter outside the classroom. Practical knowledge of conflict of values in the "real world" will help prepare students to affirm their values in the face of opposition once they have left the classroom.

A. Have students construct a questionnaire designed to assess the feelings prevalent in their community concerning the relevance and effectiveness of individual involvement. You may specify, or leave to the students' discretion:

1. Number of questions (We recommend a minimum of eight).
2. Size of sample population (We recommend a minimum of ten).
3. Composition of the sample population (homogeneity vs. heterogeneity). NOTE: We recommend that the students be instructed to not interview peers.

Suggest that the students keep the task of analysis in mind and devise a good proportion of "Yes/No" questions (perhaps 75%) while including a few questions which require lengthier response.

Sample Questions

1. Does one person have any power to affect community laws?
2. Is membership in community groups worthwhile?
3. Are you satisfied with air quality control in our community?
4. Do you have the time to take part in local hearings?
5. Do you ever write letters to the editor? Why, or why not?

B. Analysis

Ask each student to prepare a brief written report, including the following:

1. Description of the sample population (size, age, occupation)
2. Copy of the interview questions
3. Tabulation of "Yes/No" responses
4. Summary of essay responses
5. Personal conclusion: Do most people seem to believe that individual involvement is relevant and/or effective?
6. Personal reaction to the results of the survey

C. Report to Class

Ask each to briefly present his/her conclusions to the class.

Discuss:

Are conclusions similar?
Have we learned anything about our community?
What are the reasons most often given for the opinion that individual involvement is irrelevant or ineffective?

Criteria for Evaluation:

Performance:
1. construction of interview form, conduct of interview completed
2. written report completed, including the six items specified above

Program:
1. review of written reports --- Do conclusions, reactions include an awareness of the role of individual priorities? Does the student voice acceptance or rejection of the idea that individual involvement matters?
2. discussion --- Are any connections drawn between community opinion and the state of local pollution control?

SENTENCE COMPLETIONS

*Preparation:

1. Copy and distribute sentence completion sheet, (p. 52).

Purpose and Instructions:

The purpose of this exercise is to provide students with an opportunity to summarize and analyze their own attitudes towards the problem of air pollution and the potential for resolution of the problem. Hopefully, they will now draw upon their increased factual knowledge, as well as a greater sensitivity to values conflicts, as they construct their proposals and respond to one another.

Once the students have completed the sentences, ask them to share a few. Have students react to one another's answers --- practical? idealistic? sounds like him/her?

From a discussion of how realistic/idealistic/individualistic the answers are, the idea will, hopefully, emerge that there are answers. It is up to the person to choose or reject the available answers.

Criteria for Evaluation:

Performance:
1. completion of sentences
2. verbal participation in discussion

Program:
1. voluntary verbal participation, ability to analyze one another's responses in terms of personal values, societal needs, long term goals.

WHAT IS THE ANSWER TO AIR POLLUTION?

Take a few minutes to think about the topics and ideas we've talked about for the past few lessons. Think about the air quality situation in our community. Now, try to sumamrize your ideas/feelings in a very few words by completing the sentences below:

1. We need more _____.

2. We need less _____.

3. An individual _____.

CLASS PROJECT: Introduction

*Preparation: None Needed

Purpose and Instructions:

From the previous exercise, discussion can begin to focus on a very practical question: Should we, as a class, do anything (about air pollution)? Certainly, this question comes before the discussion of any ideas for a class commitment or project. The students may well choose to say "No". Open the question for discussion. Make certain the students realize that such a venture would require some of their free time. Some time may be provided during class time for initial planning, problems, etc., but the commitment is as an individual. Finally --- take a vote. You may decide to make the majority decision applicable to all, or applicable only to those voting with the majority.

If the decision is to engage in some ongoing class project, you can now move to planning. Divide students into small groups and ask them to brainstorm for a while. Ideas can be shared with the rest of the class, and proposals informally debated. Final decision on a project might be best postponed until the next class meeting to allow for some thought and/or research by the students supporting certain proposals.

Suggestions for possible class projects are:

1. Construct an Air Pollution education booklet or program for (a) younger students OR (b) community adults OR (c) peers.

2. Join a local agency volunteer program (or help start one).

3. Conduct a poster campaign in local stores, businesses, etc.

4. Compile a schedule of local hearings, meetings, etc., and attend as a class, or in small groups.

5. Develop a booklet for students on "how to have an ecologically sound lifestyle."

6. Start a Vehicle Emissions testing program in your school or community.

7. Have a "Clean Air Film Festival."

8. Investigate the status of carpooling in your school or community...and then, develop a program to improve it.

9. Find out which restaurants in your area have non-smoking sections...try to have them implemented where they don't exist.

SPEAKER EVALUATION FORM

*Preparation:

1. copy and distribute, following each resource person presentation

Purpose and Instructions:

This form is intended simply as a means of assessing the appeal and effectiveness of a classroom speaker, from the students' point of view. Completion by the students should give you some measure of the success of any given presentation and may assist you in future planning.

Criteria for Evaluation:

Performance: 1. completion

Program: 1. positive reaction to the speaker's presentation

PLEASE ANSWER THE FOLLOWING QUESTIONS CONCERNING TODAY'S PRESENTATION. YOU MAY SIGN YOUR NAME, BUT THIS IS NOT REQUIRED. SAY AS MUCH, OR AS LITTLE, AS YOU LIKE.

Name_____Date_____

1. Was the presentation clear? _____

2. Was the presentation interesting? _____

3. Were your questions answered adequately? (If not, please explain) _____
_____
_____

4. Do you think other students would appreciate a similar presentation? _____

5. Do you think your community would appreciate a similar presentation? _____

6. I would like to know more about _____
_____
_____
_____

THANK YOU

ADDITIONAL ACTIVITIES

SUBCONCEPT I: Heightened sensory awareness of the physical environment leads to appreciating and valuing that environment.

1. CLASS TRIPPING

Take a field trip with your class on the school grounds to rate the school environment. Ask the students to make three lists as follows:

1. Things I see that I love
2. Things I see that I hate
3. Things I see that have little value to me

Instruct the students to try to have at least five things on each list and not to list any one "thing" more than once. It should also be stated that people are not things and are not to be included on their lists.

After the lists are completed, ask the students to rank in order of priority the things on each list: i.e., What in my school surroundings do I love most? Hate? Is most unimportant? Compare lists and discuss why students made their particular judgements about things in the environment. Point out that usually the things we like best are those things we find most useful to us as individuals. Things we like least are usually related to the fear that these things might in some way hurt us.

Ask students whether those things they listed as having little value to them might be valuable to someone else. Might they someday become valuable to them? Do they use any of these things? Might they ever? Should we eliminate things in our surroundings because we don't use them? Why/why not?

Phillip E. Powell, et al. Man and Environment. Environmental Education Office, Arkansas Department of Education, 1974.

2. MIXING SENSES

Helping students to look at their environment anew can be interestingly accomplished by having them mix senses. In doing

so, students will develop a greater appreciation for the uniqueness of each sense and its contribution to the whole. The chart below provides one means of engaging students in a mixing-senses activity. Written compositions, or discussions answering the questions in the chart, will lead students to a heightened awareness of their senses.

Senses	Sight	Taste	Smell	Touch	Hearing
Sight		What does red taste like?	What does the sky smell like?	What do mountains feel like?	What does blue sound like?
Taste	How does sour look?		What does sweet smell like?	How does bitter feel?	What does ice cream sound like?
Smell	What does the smell of rain look like?	How does perfume taste?		What do the smells of dinner cooking feel like?	What does the smell of soap sound like?
Touch	How does soft look?	What does a rough rock taste like?	How does silky smell?		What does fur sound like?
Hearing	How does a whisper look?	What does laughing taste like?	What does barking smell like?	How does a siren feel?	

J. S. Greenberg, Student-Centered Health Instruction: A Humanistic Approach. Addison-Wesley Publishing Company, Inc., 1978.

SUBCONCEPT II: A knowledge of the nature of the atmosphere is a prerequisite for understanding the problem of air pollution.

1. Experimenting with Air

Air takes up space

Fill a large glass bowl about two-thirds full of water. Take an empty glass, invert it and place it in the bowl (see figure 1). Note that the water fills only part of the glass ...air fills the rest of the space.

Hold an empty, narrow-necked bottle under the water faucet, and fill with water. Note that the water gets into the bottle by forcing air out. To prove this: Empty the bottle. Insert a funnel in the neck of the bottle. Take a small amount of modeling clay and seal the neck of the bottle around the funnel (see figure 2). Now, try to fill the bottle with water. Note that the funnel and clay make it more difficult for the air to escape. The water goes in more slowly since it must compress the air in order to be able to occupy space in the bottle.

Air has weight

On a large sheet of newspaper, the air presses down with a weight of about five tons. To prove this: Take a yard stick, or wooden slat, and place flat on a table with about eight inches of the stick extending over the edge of the table. Open two full sheets of newspaper and place on top of the portion of the stick which is on the table (see figure 3). Now, take a hammer and strike the slat which is extending over the table edge with the hammer (strike very hard). The slat will break, as the weight of the air pressing on the newspaper keeps the other end of the slat from rising.

Air changes with changes in temperature

Fill a balloon with air, and tie it closed. Measure and record the circumference. Place the balloon in a freezer. About one hour later, take the balloon out and quickly measure the circumference again. Compare.

From sheets of looseleaf or typing paper, make two paper cones. Attach one to each end of a meter stick. Suspend the meter stick from the ceiling or a doorway by using a piece of string,

tied around the midpoint of the stick. With a cone at each end, the stick should be balanced. Now, light a candle or bunsen burner, or a stick match, and hold it beneath one cone (see figure 4). As the air inside the cone is heated, it will try to expand and rise...the meter stick will be unbalanced.

Figure 1

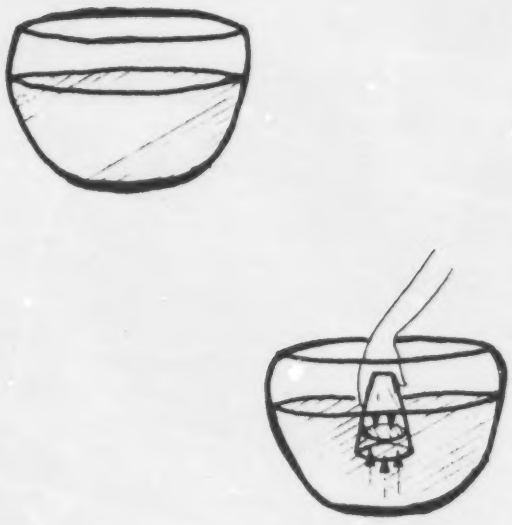


Figure 2

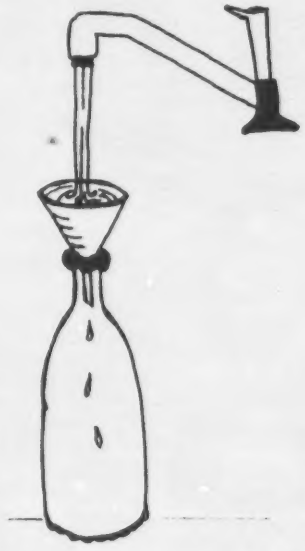


Figure 3

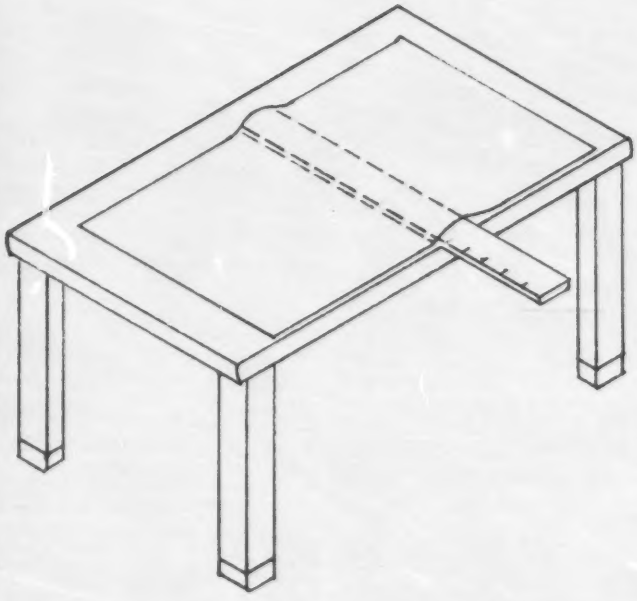
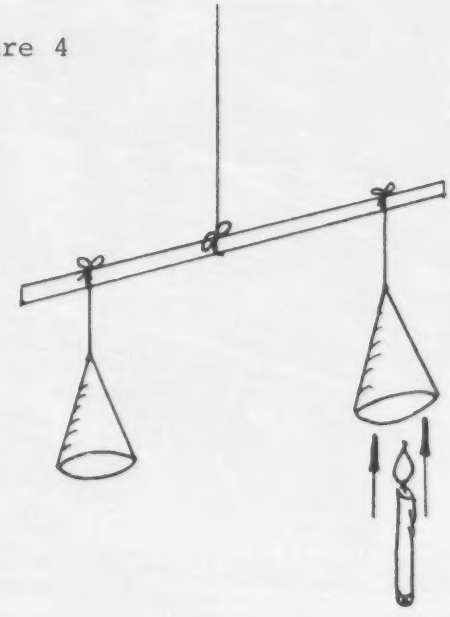


Figure 4



2. WEATHER WATCH

One means of promoting an understanding of weather patterns is to have students themselves monitor weather conditions, and discover patterns. Have students complete the chart below, for a period of at least 10 days.

WEATHER WATCH

Name_____

Date Time							
Wind Speed							
Wind Direction							
Temp (F) Temp (C)							
Relative humidity							
Amount of cloud cover							
Type of clouds							
Precipitation							
P.S.I.							
Other comments							

3. TAPEBOARD STUDY

Construct a tapeboard, using a piece of cardboard about 12" square, covered on one side with masking tape sticky side up (a piece of plastic film can be used to keep the tape clean until you are ready to start your study). The tapeboard can be used

to study airborne particles in several ways:

a) Place a tapeboard on the outside school windowsill, facing the general direction of the wind and airborne dirt.
b) Place a tapeboard on the inside school windowsill.
c) Have students make tapeboards to place in their homes for one week, then bring back to school for examination.
d) Burn a newspaper or cardboard box outside when there is a slight breeze blowing. Place several tapeboards about 4 to 6 feet upwind and downwind of the fire. Determine the difference in the amount of particulate matter collected on each. Observe smoke or its absence.

In each case, ask students what they think will happen. Watch tapeboards each day for results. Where do the particles come from? What can be done to eliminate these particles? Why is there a difference by location?

Lib Roller. Using the School and Community. Nashville Metro Schools Environmental Education Department, TN

4. DUSTFALL STUDY

Take your class on a walk around the school grounds to discover the effects of air pollution. Your students might be interested in getting a rough estimate of the dustfall in the vicinity. This may be done quite simply: A large, clean bucket is filled a quarter full of clean water and place in an exposed spot at least 6 inches above the ground. The solid particles that collect on the surface of the water after a day, a week, a month are a measure of the dustfall on a small area in a given length of time. For a city like New York the monthly amount is more than fifty tons per square mile.

Charles E. Roth, Director of Education and Miriam Dickey, Massachusetts Audubon Society, Lincoln, MA 01773

* * * * * * * * * * * * * * * *

SUBCONCEPT III: Air quality affects health and property.

1. LEARNING ABOUT COMMON POLLUTANTS

Have students complete the five statements below, and the Common Pollutants Chart on the following page. Use the pamphlet Air Pollution and Your Health as a reference, or other materials as they are available. Student answers should be the result of their research.

Statement Completions: OZONE

1. Ozone pollution is caused by _____ reactions in the air from two other pollutants, _____ and _____. Energy from _____ is needed for these reactions, therefore, the term _____. Ozone levels increase during _____ and decrease _____.

Statement Completions (continued)

2. What causes ozone in the lower atmosphere, naturally? ___ _____

3. Where is the ozone layer? _____

4. Ozone in the thin upper atmosphere absorbs a large part of _____ _____.

5. Scientists believe that the ozone layer could be reduced by such human actions as
   a. _____
   b. _____

COMMON POLLUTANTS CHART

Name _____

Fill in the chart below using Air Pollution and Your Health pages 7 - 11 as reference. If the article does not give you an answer, put NA in the space.

Pollutant	Source	State*	Effect on Body	Odor
Sulfur Oxides				
Particulates				
Carbon Monoxide				
Ozone				
Nitrogen Oxides				
Hydrocarbons				
Lead				

* Solid, liquid, or gas

2. ACTIVITIES ENJOYED

Have students list 20 things they like to do. After this list is completed, give the following instructions:

a. Place the letter "E" next to any activity requiring energy from outside sources.
b. Place the letter "A" next to those activities you prefer to do alone.
c. Place the letter "O" next to those you prefer to do with others.
d. Place the letter "W" next to any activity that produces waste products (e.g. paper to be thrown away).
e. Place the letter "R" next to any activity that employs a reusable item.
f. Place the letter "M" next to the five activities you do most often.

The following questions should then be posed by the teacher and discussed by the students:

a. Do the activities you enjoy use up our natural resources?
b. Can you use energy more efficiently by doing things with others you presently do alone?
c. Could your activities be reorganized so as to use more materials that can be recycled and less materials that cannot?
d. Do the activities you do more often use more or less energy than the activities you do less often?
e. How will you change your behavior, if at all, as a result of this activity?

J. S. Greenberg, Student-Centered Health Instruction: A Humanistic Approach. Addison-Wesley Publishing Company, Inc., 1978.

* *

SUBCONCEPT IV: Individual priorities and values may conflict with the public's need to secure and maintain environmental quality.

1. VALUES GRID

Asking students to make values choices will help them to clarify

their own values position. The Values Grid is one means to accomplish this end. Students are asked to draw a 16 square grid, with columns labelled "Very Strong," "Strong," "Mild," and "No Opinion." Sixteen statements are then read, and the students are asked to write the key word describing each statement in a place in the grid which represents their feelings regarding the statement. Sixteen statements that relate to environmental health are (key words underlined):

1. A man drives to work in his car by himself.
2. A woman takes her own shopping bags to the market.
3. A man takes his own clothes hangers to the dry cleaner.
4. A woman uses a new can of tennis balls each set.
5. A boy uses an electric can opener to open a can of soup.
6. A woman throws a cigarette butt out of her car window.
7. An industrial company pollutes the town's river.
8. A neighbor burns his trash in his backyard.
9. A school teacher writes on one side of the paper only.
10. A man keeps writing nasty letters to the newspaper about too many pages devoted to advertising.
11. A car manufacturer makes cars that can use either unleaded or leaded gasoline.
12. A mayor proposes raising taxes to install a better sewage disposal system.
13. A teenager drinks a soft drink from a non-returnable container.
14. A man washes his clothes with detergents that contain phosphates.
15. A child throws a gum wrapper in the street.
16. A mother scolds her child for spitting on the sidewalk.

A discussion of the grids should focus on the reasons for certain statements eliciting stronger feelings than others.

J. S. Greenberg, Student-Centered Health Instruction: A Humanistic Approach. Addison-Wesley Publishing Company, Inc., 1978.

2. SIMULATED CITIZENS

Present the following problem to your class:

An industry in town is putting out great quantities of black smoke as a result of the burning of its waste products. The town is located in a valley which means the smoke is not blown away easily. A group in town has formed to stop pollution of the air. This group is complaining to the town council about the smoke problem.

The industry says it cannot afford to change its method of waste disposal. Other people in town oppose the control of the smoke because they feel it will discourage industry from moving to their town. They say it would prevent economic development.

Divide the class into the following groups: Town Council, industry representatives, Citizens for Clean Air, Citizens for Economic Development (see description in following paragraph).

Each group should meet and discuss what it wants the Town Council to do about the smoke problem, and what the group thinks is needed to make this a better place to live. The ideas should be based upon some research into the problem, not just personal opinion. Elect a spokesman for each group to present its case to the Town Council when the class meets again as a whole.

The Town Council should elect one of its members to be in charge of the meeting. After listening to the representatives from the different organizations, the Town Council should come up with a list of priorities, a list of what it is going to act upon first, second, etc. Your class may wish to invite a member of the real Town Council to meet with you and discuss your ideas.

Each group should be presented with the following descriptions:

1. Town Council --- This is the town's governing body which will decide whether the smoke pollution will be stopped. The purpose of the other groups is to persuade this council through their representatives that their position is correct.

2. Industry Representatives --- This group represents the industry which is causing the smoke pollution. They are naturally concerned with their interests and want to keep their profits at a maximum. However, they are interested in public opinion and may respond to public pressure. The group claims that their economic development will be harmed if strong controls on smoke emissions become law.

3. Citizens for Clean Air --- This group is determined to solve the smoke problem as soon as possible. Its members believe that a clean environment is more important than a profitable industry in town. The group also believes that the waste product being burned could be put to valuable use.

Most of the people of this group do not depend on the industry for their jobs.

4. Citizens for Economic Development --- This group is composed of businessmen and also people who work for the industry causing the smoke pollution. They are siding with the industrial group since they are concerned with the town's economy. However, this group realizes that environmental quality is important and might seek a slow, gradual solution to the problem so that the industry is not hurt.

All Around You - An Environmental Study Guide, Bureau of Land Management, United States Dept. of the Interior, Washington, D.C.

* * * * * * * * * * * * * * * * *

SUBCONCEPT V: An understanding of the present air quality control structure provides a basis for decision-making concerning individual action.

1. Belief Defense

Discuss with students that often when we form a belief and express it with others, we need to be able to support and defend our positions. To do this successfully, we need to clearly express our beliefs and back them up with supporting evidence.

Present the following situations to your students and ask them to respond and defend their positions:

Someone says to you: "I can afford it. That's why I drive a big car with air conditioning."
And you reply: "....."

The editorial in the paper says: "Trees are more valuable standing than converted into lumber. We should develop a national policy to use only recycled fibre for paper and use lumber only when absolutely necessary."
And you write a letter to the editor stating:
"....."

A close friend laments, "There's just no chance. People are basically greedy, politicians are dishonest and the giant corporations aren't about to clean up their deadly pollution."
And you share your feelings: "....."

David L. Hanselman, SUNY College of Environmental Science and Forestry, Syracuse, New York 13210.

* * * * * * * * * * * * * * * * *

SUBCONCEPT VI: Each person is responsible, both individually and collectively, for the environment in which he/she lives.

1. Values Quadrant

One manner of organizing environmentally related data and determining what students can do to improve the environment is to develop Values Quadrants.

Students are asked to draw a large square and divide it into four equal parts (quadrants). In one quadrant they are to list three places they frequently attend that add pollutants to the environment; in another quadrant three people they personally know who could be classified as "polluters"; in a third quadrant three places they attend which do not add pollutants to the environment; and in the last quadrant three people who are not "polluters." The following questions should then be posed and discussed:

1. What could you do to get the pollutant places to be less pollutant?
2. What could you do to get the pollutant people to be less pollutant?
3. What could you do to prevent the nonpollutant places and people from becoming polluters?
4. Who could help you accomplish 1 and 2 above?
5. Who would try to prevent you from accomplishing 1 and 2 above?

6. In which quadrant would you place yourself?

7. What have you learned as a result of this activity?

2. Values Voting

As with other content areas, Values Voting can be used effectively to help students explore their values related to the environment. The following questions are suggested:

1. How many of you would form a car pool to get to school?

2. How many of you walk or ride a bicycle when going short distances?

3. How many of you have ever picked up trash lying on the street?

4. How many of you would stop someone who has thrown a gum wrapper on the street and explain the harm this does?

5. How many of your family cars have been tuned up in the last six months?

6. How many of you would buy soft drinks in nonreturnable containers?

7. How many of you turn lights out when you are the last person to leave a room?

8. How many of you would be willing to separate your weekly trash into two piles - material to be recycled and material that can't?

J. S. Greenberg, Student-Centered Health Instruction: A Humanistic Approach. Addison-Wesley Publishing Company, Inc., 1978.

3. Photography Survey

Assign students (several weeks in advance) to take pictures of local environmental problems, such as abandoned cars, rubbish-filled lots, smoke stacks issuing forth black smoke, parks which need cleaning or are in total disrepair, etc.

When the pictures have been developed (use slides or prints - to show prints to the class use an opaque projector), show each of the pictures and discuss where the problem is (possibly mark the trouble spots on a map of the area); what the problem is; and a possible solution to the problem (one solution is to have students write letters to various officials enlisting their aid in helping to correct the problem).

Put the pictures on the bulletin board with copies of letters, written by the students, to the appropriate agencies or officials who could help remedy the situation. The replies received can also be placed on the bulletin board along with follow-up pictures if appropriate action has occurred.

Our Environment: A Collection of Lessons. Council on the Environment of New York City, 51 Chambers Street, New York, NY 10007, 1975.

RESOURCES

ORGANIZATIONS

American Lung Association/San Jacinto Area
2901 West Dallas
Houston, Texas 77019
(713) 521-9561

Citizens' Environmental Coalition
One Main Plaza, Suite 1006-A
Houston, Texas 77002
(713) 228-0037

City of Houston Air Pollution Control
City of Houston Health Department
1115 North MacGregor
Houston, Texas 77030
(713) 222-4302

ERIC-Clearinghouse for Science, Math and Environmental Education
The Ohio State University
1200 Chambers Road, Third Floor
Columbus, Ohio 43212

Environmental Protection Agency, Region 6
1201 Elm Street
Dallas, Texas 75270

Houston-Galveston Area Council
P.O. Box 22777
Houston, Texas 77027
(713) 627-3200

League of Women Voters
1947 West Gray, Room 202
Houston, Texas 77019

Sierra Club
One Main Plaza, Suite 1006-A
Houston, Texas 77002

Texas Air Control Board
5555 West Loop South
Bellaire, Texas 77401
(713) 666-4964

AUDIOVISUAL MATERIALS

AIR POLLUTION THE FACTS --- a 27-minute color film presents the various elements to be considered in the treatment of air pollution - health effects, pollutant transport, air quality standards, control mechanisms, and the cost of control versus the cost of continued pollution. Available from the American Lung Association.

CHARLIE BROWN CLEARS THE AIR --- a 6½-minute color animated film dramatizing environmental problems and pollutions, featuring the Charlie Brown cast of characters. Available from the American Lung Association and the Environmental Protection Agency.

ON THE ROAD TO CLEAN AIR --- a 17-minute color film covers the purpose and need for Inspection and Maintenance programs, the benefits and costs, and how a program operates. Available from the American Lung Association and the Environmental Protection Agency.

ROX, SOX, NOX --- a 12¼-minute color film using test-tube demonstrations to dramatically show the complex cause/effect relationships involved in air pollution. Available from the American Lung Association.

TRANSPORTATION AIR QUALITY PLANNING --- a 28-minute or 15-minute presentation to explain why the Houston-Galveston Area Council is looking at certain air control measures to reduce the vehicle and transportation emissions in the Houston area. Available from the Houston-Galveston Area Council.

PUBLICATIONS

AIR POLLUTION PRIMER --- a 105-page resource book discusses sources, effects, and processes of air pollution in easy-to-understand terms. Available from the American Lung Association.

ENVIRONMENTAL EDUCATION IN THE URBAN SETTING: RATIONALE AND TEACHING ACTIVITIES --- by Herbert L. Coon and Mary Lynne Bowman, this book is available from ERIC, Ohio State University.

GET A CHECK-UP FOR YOUR CAR --- a leaflet on the need for keeping cars well maintained to cut pollution along with pointers on what can go wrong with your engine and what to do about it. Available from the American Lung Association and the Environmental Protection Agency in English or Spanish.

A GLOSSARY ON AIR POLLUTION --- this leaflet defines technical terms used in connection with air pollution. Available from the American Lung Association.

THE HEALTH EFFECTS OF AIR POLLUTION --- a 16-page pamphlet which discusses the various air pollutants and the affects they have on health. Available from the Environmental Protection Agency.

THE NEW AIR BOOK --- Melvin Bergur, Krowel Publishers, Inc., New York, 1974.

THE POLLUTANT STANDARDS INDEX --- an 8-page brochure explaining the Pollutant Standard Index (PSI), an index reporting the concentration of air pollution in an area. Available from the Environmental Protection Agency.

THE RESPIRATORY SYSTEM --- an 11" x 14" or 17" x 22" chart of the respiratory system detailed with the various apparatus for breathing, including vocabulary. Available from the American Lung Association.

STUDENT-CENTERED HEALTH INSTRUCTION: A HUMANISTIC APPROACH --- by Jerrold S. Greenberg and published by Addison Wesley Publishing Company, California, 1978.

TUNING DOWN AUTO AIR POLLUTION --- a 16-page booklet which discusses the need for Inspection and Maintenance programs, the benefits and costs, and how a program works. Available from the Environmental Protection Agency.

VALUES ACTIVITIES IN ENVIRONMENTAL EDUCATION --- by Mary Lynne Bowman, this book is available from ERIC, Ohio State University.

ACKNOWLEDGEMENTS

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